



Billing Code 4910-13

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. FAA-2018-0229; Special Conditions No. 25-720-SC]

Special Conditions: Bombardier Inc. BD-700-2A12 and BD-700-2A13 Airplane; Flight

Envelope Protection: Normal Load Factor (g) Limiting

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions; request for comments.

SUMMARY: These special conditions are issued for the Bombardier Inc. (Bombardier) Model BD-700-2A12 and BD-700-2A13 airplanes. These airplanes will have a novel or unusual design feature when compared to the state of technology envisioned in the airworthiness standards for transport-category airplanes. This design feature will use a fly-by-wire electronic flight control system (EFCS) that will prevent the flight crew from inadvertently or intentionally exceeding the positive or negative airplane limit-load-factor. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

DATES: This action is effective on Bombardier Inc. on **[INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER]**. Send your comments by **[INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

ADDRESSES: Send comments identified by docket number FAA-2018-0229 using any of the following methods:

- *Federal eRegulations Portal:* Go to <http://www.regulations.gov/> and follow the online instructions for sending your comments electronically.
- *Mail:* Send comments to Docket Operations, M-30, U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE., Room W12-140, West Building Ground Floor, Washington, DC, 20590-0001.
- *Hand Delivery or Courier:* Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.
- *Fax:* Fax comments to Docket Operations at 202-493-2251.

Privacy: The FAA will post all comments it receives, without change, to <http://www.regulations.gov/>, including any personal information the commenter provides. Using the search function of the docket Web site, anyone can find and read the electronic form of all comments received into any FAA docket, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). DOT's complete Privacy Act Statement can be found in the **Federal Register** published on April 11, 2000 (65 FR 19477-19478).

Docket: Background documents or comments received may be read at <http://www.regulations.gov/> at any time. Follow the online instructions for accessing the docket or go to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Joe Jacobsen, FAA, Airplane and Flight Crew Interface Section, AIR-671, Transport Standards Branch, Policy and Innovation Division, Aircraft Certification Service, 2200 S. 216th St., Des Moines, Washington 98198-6547; telephone 206-231-3158; facsimile 425-231-3398.

SUPPLEMENTARY INFORMATION: The substance of these special conditions has been published in the **Federal Register** for public comment in several prior instances with no substantive comments received. Therefore, the FAA has determined that prior public notice and comment are unnecessary, and finds that, for the same reason, good cause exists for adopting these special conditions upon publication in the **Federal Register**.

Comments Invited

We invite interested people to take part in this rulemaking by sending written comments, data, or views. The most helpful comments reference a specific portion of the special conditions, explain the reason for any recommended change, and include supporting data.

We will consider all comments we receive by the closing date for comments. We may change these special conditions based on the comments we receive.

Background

On May 30, 2012, Bombardier applied for an amendment to Type Certificate No. T00003NY to include the new Models BD-700-2A12 and BD-700-2A13 airplanes. The Model BD-700-2A12 and BD-700-2A13 airplanes, which are derivatives of the BD-700 series currently approved under Type Certificate No. T00003NY. The Model BD-700-2A12 and BD-700-2A13 airplanes augment the existing BD-700 family of airplane and are marketed as the Bombardier Global 7000 and Global 8000 airplanes, respectively. These are business jets with a maximum

certified passenger capacity of 19. The Model BD-700-2A12 and BD-700-2A13 airplanes will have a maximum takeoff weight of 106,250 lbs. and 104,800 lbs., respectively.

Type Certification Basis

Under the provisions of title 14, Code of Federal Regulations (14 CFR) 21.101, Bombardier must show that the Model BD-700-2A12 and BD-700-2A13 airplanes meet the applicable provisions of the regulations listed in Type Certificate No. T00003NY or the applicable regulations in effect on the date of application for the change except for earlier amendments as agreed upon by the FAA.

If the Administrator finds that the applicable airworthiness regulations (i.e., 14 CFR part 25) do not contain adequate or appropriate safety standards for the Model BD-700-2A12 and BD-700-2A13 airplanes because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

Special conditions are initially applicable to the model for which they are issued. Should the type certificate for that model be amended later to include any other model that incorporates the same novel or unusual design feature, or should any other model already included on the same type certificate be modified to incorporate the same novel or unusual design feature, these special conditions would also apply to the other model under § 21.101.

In addition to the applicable airworthiness regulations and special conditions, the Model BD-700-2A12 and BD-700-2A13 airplanes must comply with the fuel-vent and exhaust-emission requirements of 14 CFR part 34 and the noise-certification requirements of 14 CFR part 36.

The FAA issues special conditions, as defined in 14 CFR 11.19, in accordance with § 11.38, and they become part of the type certification basis under 21.101.

Novel or Unusual Design Features

The Model BD-700-2A12 and BD-700-2A13 airplanes will incorporate the following novel or unusual design feature:

The Model BD-700-2A12 and BD-700-2A13 airplanes will use a fly-by-wire electronic flight control system (EFCS) that will prevent the flight crew from inadvertently or intentionally exceeding the positive or negative airplane limit-load-factor. This feature is considered novel or unusual because the current regulations do not provide standards for maneuverability and controllability evaluations for such systems. Therefore, special conditions are needed to ensure adequate maneuverability and controllability when using this design feature.

Discussion

Title 14, Code of Federal Regulations, part 25 does not specify requirements or policy for demonstrating maneuver control that impose any handling qualities requirements beyond the design limit structural loads. Nevertheless, some pilots have become accustomed to the availability of this excess maneuver capacity in case of extreme emergency such as upset recoveries or collision avoidance.

As with previous fly-by-wire airplanes, the FAA has no regulatory or safety reason to prohibit a design for an electronic flight control system with load factor limiting. It is possible that pilots accustomed to this feature feel more freedom in commanding full-stick displacement maneuvers because of the following:

- a. Knowledge that the limit system will protect the structure,
- b. Low stick force/displacement gradients,
- c. Smooth transition from pilot elevator control to limit control.

These special conditions will ensure adequate maneuverability and controllability when using this design feature.

The normal load factor limit on the Model BD-700-2A12 and BD-700-2A13 airplanes is unique in that traditional airplanes with conventional flight control systems (mechanical linkages) are limited in the pitch axis only by the elevator surface area and deflection limit. The elevator control power is normally derived for adequate controllability and maneuverability at the most critical longitudinal pitching moment. The result is that traditional airplanes have a significant portion of the flight envelope wherein maneuverability in excess of limit structural design values is possible.

These special conditions for the Model BD-700-2A12 and BD-700-2A13 airplanes supplement the applicable regulations, including § 25.143, to accommodate the unique features of the flight envelope limiting systems, and establish an equivalent level of safety to the existing regulations.

These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

Applicability

As discussed above, these special conditions are applicable to the Model BD-700-2A12 and BD-700-2A13 airplanes. Should Bombardier apply at a later date for a change to the type certificate to include another model incorporating the same novel or unusual design feature, these special conditions would apply to that model as well.

Conclusion

This action affects only certain novel or unusual design features on Model BD-700-2A12 and BD-700-2A13 airplanes. It is not a rule of general applicability.

List of Subjects in 14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

The authority citation for these special conditions is as follows:

Authority: 49 U.S.C. 106(f), 106(g), 40113, 44701, 44702, 44704.

The Special Conditions

Accordingly, pursuant to the authority delegated to me by the Administrator, the following special conditions are issued as part of the type certification basis for Model Bombardier BD-700-2A12 and BD-700-2A13 airplanes.

Flight Envelope Protection: Normal Load Factor (g) Limiting

1. To meet the intent of adequate maneuverability and controllability required by § 25.143(a), and in addition to the requirements of § 25.143(a) and in the absence of other limiting factors, the following special conditions based on § 25.333(b) apply:

a. The positive limiting load factor must not be less than:

(1) 2.5g for the normal state of the electronic flight control system with the high lift devices retracted.

(2) 2.0g for the normal state of the electronic flight control system with the high lift devices extended.

b. The negative limiting load factor must be equal to or more negative than:

(1) Minus 1.0g for the normal state of the electronic flight control system with the high lift devices retracted.

(2) 0.0g for the normal state of the electronic flight control system with high lift devices extended.

c. Maximum reachable positive load factor, wings level, may be limited by the characteristics of the electronic flight control system or flight envelope protections (other than load factor protection) provided that

(1) the required values are readily achievable in turns, and

(2) wings-level pitch up is satisfactory.

d. Maximum achievable negative load factor may be limited by the characteristics of the electronic flight control system or flight envelope protections (other than load factor protection) provided:

(1) Pitch down responsiveness is satisfactory, and

(2) From level flight, $0g$ is readily achievable or alternatively, a satisfactory trajectory change is readily achievable at operational speeds. For the FAA to consider a trajectory change as satisfactory, the applicant should propose and justify a pitch rate that provides sufficient maneuvering capability in the most critical scenarios.

e. Compliance demonstration with the above requirements may be performed without ice accretion on the airframe.

These special conditions do not impose an upper bound for the normal load factor limit, nor do they require that the limiter exist. If the limit is set at a value beyond the structural design limit maneuvering load factor “ n ” of §§ 25.333(b) and 25.337(b) and (c), there should be a very obvious positive tactile feel built into the controller so that it serves as a deterrent to inadvertently exceeding the structural limit.

Issued in Des Moines, Washington, on March 15, 2018.

Victor Wicklund,
Manager, Transport Standards Branch,
Policy and Innovation Division,
Aircraft Certification Service.
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